

BUILDING ENERGY SIMULATION

*For Users of EnergyPlus, SPARK, DOE-2, BLAST, Genopt,
Building Design Advisor, ENERGY-10 and their Derivatives*

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SPARK is an equation-based simulation environment that allows you to build customized models of complex physical processes by connecting calculation objects that represent system components like walls, fans, heat exchangers, chillers, ducts, mixing boxes, controls, etc. It is aimed at the simulation of innovative and/or complex building systems that are beyond the scope of whole-building programs like EnergyPlus. VisualSPARK adds a graphical user interface to SPARK to simplify use of the program.

Version 2.0 of the VisualSPARK environment for simulation of advanced building energy systems has been released. For more information on VisualSPARK, a complete list of new features, or to download the program free of charge, please go to <http://SimulationResearch.lbl.gov> > VisualSPARK. A few of the new features are described below. More information on these features can be found in the VisualSPARK 2.0 Users Guide and the SPARK 2.0 Reference Manual

New Features of VisualSPARK 2.0

GRAPHICAL USER INTERFACE IMPROVEMENTS

- Tree-view of problem showing objects associated with the problem.
- Right-clicking on a project name now pops up a menu with choice to edit the problem file or show the tree structure of the problem.
- Right-clicking on a class name pops up a menu from which you may choose to edit the class file or show the tree structure of the class.
- Checkbox to allow variable time step and inputs for minimum and maximum time step.
- Wall clock entries to choose date and time for run (e.g., for reading weather file data).
- Comparative plots of related problems: you can show the same output variables from multiple runs of problems on the same graph.
- New tab showing Structure and Defaults in the Component Preference Editor:
 - Structure: shows problem structure as a tree; you can browse inverses, parameters, input variables and unknowns.
 - Defaults: shows default values for solution methods, maximum number of iterations, etc.
- Component tab shows component structures as trees, where you can browse unknowns and objects, including their inverses, targets and callbacks.

VARIABLE TIME STEPPING

- Atomic classes have been added to describe integration methods with variable time stepping and control of the local truncation error. Adaptive integrators can save computational speed by using a larger time step when the time derivatives tend to zero. Also, they ensure the accurate simulation of fast transient processes by automatically selecting a time step small enough to satisfy the user-specified tolerance.
- The integration class framework supports only predictor-corrector integration schemes so far. Implementations of the Euler scheme and the trapezoidal scheme are provided as part of the SPARK global classes.

NEW RUNTIME CONTROL PARAMETERS

- Added the following keys in the .run file:
- `InitialConsistentCalculation` to indicate whether or not to calculate consistent values at the initial time by solving for the time derivatives of the dynamic variables using the specified boundary conditions.
- `InitialTimeStep` to specify the value of the initial time step.
- `VariableTimeStep` to indicate whether or not to vary the time step during the simulation.
- `MinTimeStep` to specify the smallest allowed time step.
- `MaxTimeStep` to specify the largest allowed time step.

(continued)

IMPROVED SOLUTION METHODS

- Integrated the newest release of UMFPACK for the sparse linear solver. This method reduces calculation time by orders of magnitude on large simulation problems that have a sparse Jacobian matrix.
- Added perturbed Newton solution method to solve badly-conditioned nonlinear systems.
- Added keys in the preference file for safety factors used in the convergence test (for Prediction/Iteration stage and Break/Normal unknown variables).
- Added a key in the Preference file to specify the minimum number of iterations when solving the strong components.
- Added variable scale for all problem variables.

READ URL MECHANISM

- This is a generalized way of specifying where and how input values are obtained at runtime. With this mechanism SPARK can now read:
 - EnergyPlus, DOE-2 and TMY weather files
 - DOE-2 schedules
 - Algebraic expressions
 - ASCII formatted files

MULTI-VALUED INVERSE FUNCTIONS

- In SPARK 1 all inverse functions were single-valued, i.e., the inverse returned only one value. SPARK 2 allows inverse functions to return two or more values simultaneously. This new capability allows solving multiple equations for multiple variables simultaneously within the same subsystem model. This approach is of particular interest when dealing with the following modeling issues:
- When writing the model classes, situations arise where you would like to use a model expressed in an algorithmic language within a SPARK model. This comes up when there is an existing, trusted model written in a procedural language, e.g., FORTRAN or C, and time or other factors argue against re-implementation as an equation-based SPARK model using single-valued atomic classes.
- Sometimes there are small sets of equations within a system that are numerically problematic for any global iterative solution scheme, but which can be reliably solved simultaneously with well-known procedural algorithms.

RESIDUAL INVERSE FUNCTIONS

- For complex equations some inverses may be difficult or impossible to obtain as functions in explicit form. Or, it may be that special knowledge about the problem under investigation suggests that a particular inverse should not be used because it might lead to numerical difficulties.
- To deal with such situations it is now possible to specify inverses that do not return the values of the target ports but instead return the residual values for the equations assigned to each target port. Such an inverse is said to be expressed in residual form.
- Another situation where it is not desired to express an inverse in explicit form occurs when the inverse acts as a wrapper around a third-party program that calculates residual equations. Such a program, typically a legacy code, cannot easily be changed to return the values of the target ports. Instead you can embed it unchanged in a multi-valued, residual inverse.

DEFAULT RESIDUAL INVERSE FUNCTIONS

- A default residual inverse can be specified at the atomic class level. The program will use this default inverse when no other explicit inverse satisfies the matching requirements. Specifying a default residual inverse for classes with missing direct inverses for certain target ports significantly improves the likelihood of finding a complete matching during the SPARK graph-theoretical analysis.

CLASS TYPES

- The new language keyword `CLASSTYPE` has been added to identify the type of each atomic class. Typing of the atomic classes allows providing special behavior for these classes during the graph-theoretical analysis and/or the numerical solution phase at runtime. Supported class types are: `DEFAULT`, `SINK` and `INTEGRATOR`.

(continued)

CALLBACK FRAMEWORK

- Each inverse in an atomic class consists of a set of callback functions that are invoked by the solver at specific points of the simulation process. SPARK 1 let you define only two different callback functions for each inverse: the `EVALUATE` callback, which calculates and returns the values for the target ports, and the `PREDICT` callback, which returns the predicted values of the break variables.
- The callback framework has been extended in SPARK 2. This new collection of callbacks enhances the object-oriented capabilities of the SPARK atomic classes by providing support for data encapsulation. The callback framework consists of *instance* callbacks and *static* callbacks. Instance callbacks are fired for each instance of the inverse, whereas the static callbacks are fired only once for each inverse type appearing in the problem.
- The callback functions are categorized into four groups: *modifiers*, *structors*, *non-modifiers* and *predicates*. Modifier callbacks return a value or multiple values (in the case of a multi-valued inverse). Non-modifier callbacks do not return any value. They are usually used to perform operations on the private data. Structors are typically used to allocate and deallocate private data. Predicate callbacks return a boolean value pertaining to the discrete state of the atomic class.

PRIVATE DATA

- Thanks to the callback framework it is possible in SPARK 2 to attach private data to each inverse. We distinguish between *instance data* that is specific to each instance of the inverse and *static data* that is shared by all instances of the same inverse. The structor callbacks are used to allocate and deallocate the private memory required by each inverse instance. The private data can then be retrieved and updated from within the other callback functions.

REQUEST FRAMEWORK

- Requests can be sent from the callback functions to influence the behavior of the simulator. In particular, time-event requests have been defined to synchronize the operation of the solver with user-specified meeting points. Also, state-transition requests let you restart the simulation by solving a static step, stop it, or abort it. Finally, utility requests can be sent to generate a report or a snapshot file at the current time.

XML PROBLEM DESCRIPTION

- The problem topology is now described by an XML file. This allows having a compiler- and linker-free SPARK as long as all atomic classes are compiled and built as dynamic libraries.

NEW DRIVER API

- Now supports both static and dynamic build operations in the driver function.
- The runtime problem loader now supports explicit linking from dynamic libraries.
- New API functions facilitate the integration of the SPARK solver in an external driver function, thus making it easier to use SPARK as a simulation kernel.



SPARK is an equation-based simulation environment that allows you to build customized models of complex physical processes by connecting calculation objects that represent system components like walls, fans, heat exchangers, chillers, ducts, mixing boxes, controls, etc. It is aimed at the simulation of innovative and/or complex building systems that are beyond the scope of whole-building programs like DOE-2 and EnergyPlus. VisualSPARK adds a graphical user interface to SPARK to simplify use of the program.

Download VisualSPARK from <http://simulationresearch.lbl.gov/>

SPARK was developed by the Simulation Research Group at Lawrence Berkeley National Laboratory and by Ayres Sowell Associates, with support from the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology Programs of the U. S. Department of Energy, Program Manager Dru Crawley.

EnergyPlus

Whole Building Energy Simulation Program

To download a free copy of EnergyPlus go to

www.energyplus.gov



EnergyPlus Support Tools

Support software is listed on our website (http://simulationresearch.lbl.gov/EP/ep_tools.html) and in Section 2 of this newsletter.

EnergyPlus Weather Data from www.energyplus.gov/

There are 275 locations in the United States, 16 California thermal zones, 55 Canadian locations, and 233 international locations in more than 80 countries. We recommend that you also download the weather utility RPT file for each location. The RPT file includes design data where available, statistics for the weather file, including typical and extreme periods (hottest summer week, coldest winter week, typical spring week, etc), Koppen climate classification, heating and cooling degree days, monthly average minimum and maximum dry bulb and dew point temperatures, undisturbed ground temperatures, direct and diffuse solar radiation, relative humidity, and wind speed and direction.

Ask an EnergyPlus Expert

Questions from EnergyPlus users are answered by program developers. Download the 2002 Q&A pdf file from gundog.lbl.gov/dirpubs/un_articleEP02.pdf. To submit questions, join the EnergyPlus User Group: http://groups.yahoo.com/group/EnergyPlus_Support/

Are you an EnergyPlus Consultant ?

If you are engaged in EnergyPlus consulting, and would like to be listed in the *Building Energy Simulation User News* and on our website (<http://SimulationResearch.lbl.gov>), please send email to klrellington@lbl.gov.

Join the EnergyPlus User Group

The developers of EnergyPlus have formed a support group to foster discussion and maintain an archive of information for program Users. We invite questions about program usage and suggestions for improvement to the code. Go to http://groups.yahoo.com/group/EnergyPlus_Support/

Translate EnergyPlus Web Pages

A new link on the main EnergyPlus web page (www.energyplus.gov/) allows you to view the pages in any of eight languages. Unfortunately, the translator doesn't work with PDF files. Look for the fish at the bottom of the web page. Pages may be translated into Chinese, French, German, Italian, Japanese, Korean, Portuguese and Spanish.

EnergyPlus is being developed by University of Illinois, and Lawrence Berkeley National Laboratory, with the assistance of DHL Consulting, Florida Solar Energy Center, GARD Analytics, the National Renewable Energy Laboratory, Oklahoma State University and others. Development of EnergyPlus is supported by the U. S. Department of Energy, Dru Crawley, Program Manager.



Ask An EnergyPlus Expert



Purchased Hot Water

Question

We use the UnitHeater example and we would like to know if we can control the temperature of inlet and outlet of the water in the Purchased:Hot Water. We think that the temperature of the outlet water is controlled by the loop temperature setpoint schedule but we don't know for sure.

Answer

Yes, the outlet temperature from PURCHASED:HOT WATER will be the loop setpoint if the capacity is sufficient. The inlet temperature is determined by the coil loads and the loop flow rate.

Question

What kind of buildings use this type of system of heating?

Answer

This type of system is typically used by buildings in an urban area with district heating available. It is also an option for modelers who want to look just at plant loads without simulating a boiler (or chiller, PURCHASED:CHILLED WATER).

Cooling and Heating Capacity Limit

Question

I would like to limit the cooling and heating capacity of a system. On the one hand, when applying an electric baseboard heater the nominal capacity can be limited. On the other hand, in the case of a DX cooling coil, the rated capacity refers to design conditions but the effective capacity at a time step (output variable) can be beyond the rated one. What system allows specifying a cooling capacity limit that cannot be exceeded in the simulation run?

Answer

The only way to limit cooling capacity is to use a chilled water system. A fan coil unit would probably be the easiest. Use purchased chilled water to serve the chilled water supply loop, because it has a fixed capacity limit. When the limit is reached, the chilled water temperature will rise above setpoint and limit the total cooling that can be delivered to the space. There is some lag in the chilled water loop, so you may see some small variations in cooling capacity when the system is at the limit.

DOE-2 to EnergyPlus Converter

Question

I have some DOE-2 files that I would like to convert and run in EnergyPlus. Is there a software package that would allow me to do this.

Answer

Read about the DOE-2 to EnergyPlus translator in *gettingstarted.pdf* under *creating input files, doe2translator* (pg 43 of 53). Note that the DOE-2 to EnergyPlus translator does not convert HVAC systems/equipment.



Ask An EnergyPlus Expert



Load and Energy Balance

Question

- 1) What is the best/easiest way to find out a building's hourly total cooling load using EnergyPlus?
- 2a) How can I verify that the cooling plant is providing enough (or not enough) energy to meet the building load on an hourly basis?
- 2b) Also, I pulled out some outputs from EnergyPlus and tried to do a balance check but it didn't match.

Answer

- 1) The easiest way to determine the sensible load requirements to maintain the specified thermostat setpoints is to use the purchased air simulation with no capacity limits and include outside air if applicable. This will also provide a rough approximation of latent load requirements.
- 2a) If the thermostat setpoints are being met, then the cooling plant is providing enough cooling; this is the only available measure of performance. Use the report:table:bin feature to see the distribution of temperatures in the zones; you can then determine whether the setpoints are being met.
- 2b) It is very difficult to do a simplified energy balance calculation which will agree with the simulation result. To balance the building envelope, you must reduce the problem to a steady-state condition by defining a constant temperature day with no sunshine. Balancing loads within the HVAC simulation is easier since each time step is a quasi-steady-state simulation, but there are still many details which must be accounted for.

Meaning of Output Variables

Can anybody explain to me the meaning of these output variables:

- **Layer Rel Humidity[]. Units**

This is the Relative Humidity inside the construction at each layer interface. Relative Humidity is explained in just about every Thermodynamic text book, ASHRAE Handbook of fundamentals, and any Psychrometric book. It is unit-less and runs normally between 0 and 1, where anything greater than 1.0 there would be condensation. This value can be reported along with the humidity ratio to help the user determine if there was or could be condensation in the wall construction.

- **Outside Surface Mass Flux[kg/s/m²]**

The Surface Mass Flux would be the amount [kg] of moisture that would enter or leave that material at the outside face.



Ask An EnergyPlus Expert



Use a Batch Command to Queue EnergyPlus Simulations

Question

I have to run quite a lot of (large and time consuming) simulations. Is it possible to use a batch file to queue the IDF files?

Answer

Yes, you can run EnergyPlus with batch files. There is a batch file included, called "RunEplus.bat" in the main EnergyPlus folder. Just write another batch file which calls RunEplus.bat multiple times. (Note, use the "call" command to execute RunEplus so that the main batch file will wait until it is complete). For more information about RunEplus.bat, see the Getting Started document, pp. 14-18.

Optimize EnergyPlus Runs

Question

Also, given a fixed building design, I'm trying to optimize the orientation that would result in the lowest energy consumption (maximum self shadow from the building). How can I do this in EnergyPlus?

Answer

There are a couple of options:

- 1) [GenOpt](http://SimulationResearch.lbl.gov/) (SimulationResearch.lbl.gov/) from LBNL can be used to drive EnergyPlus for optimizing building rotation.
- 2) Also, the Deringer Group has developed a tool called EZPlus-Parm, available for free download at their web site: www.deringergroup.com/Software/EPlusTools.htm
EZPlus-Parm is a standalone Windows tool intended primarily for EnergyPlus parametric analysis. It was designed to simplify the running of multiple parametric EnergyPlus simulations.

Running COMIS with HVAC

Question

I know that COMIS is not supposed to give reliable results when the HVAC system is running but is this only true when mechanical ventilation is present where outside air is being brought in. If my HVAC system just recirculates the inside air such that the conditioning system is not pressurizing or depressurizing the zone, will the COMIS results be accurate.

Answer

The COMIS simulation calculates the pressures and corresponding flows based on the interior and outdoor environmental conditions from the previous timestep, i.e., it does not know anything about pressures or flows that may result from the HVAC operation. So, theoretically, if your system is simply recirculating inside air perfectly without any pressurization effects, this should not impact the COMIS predicted flows and pressures.

So, if your HVAC system is not pressurizing or depressuring the zone, the COMIS results should be OK.



Ask An EnergyPlus Expert



Moisture Storage and Passive Humidity Control

Question

I am trying to model passive humidity control using building materials as moisture and thermal flywheels. Most of the rooms are internal zones, with mass walls such that moisture and thermal effects from adjacent zones will be minimized. I'd like to be able to look at design days and hopefully at longer term simulations as well. Is EnergyPlus capable of this?

Answer:

Yes, EnergyPlus can model this using the EMPD (effective mean penetration depth) method. Since material property data for moisture modeling is limited, you should run sensitivities on this and qualify your results accordingly.

PID Controlled Valve

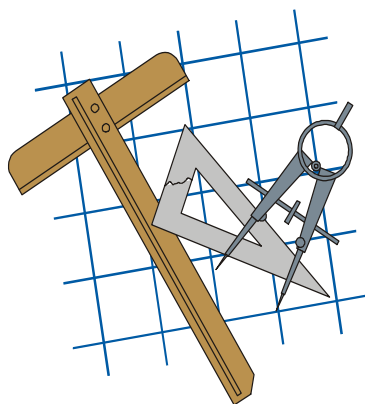
Question

If a constant speed pump is used in the plant, the flowrate is controlled by mixing valve. How to model a PID controled mixing valve in EnergyPlus?

Answer

EnergyPlus controllers are not modeled as proportional or PI or PID. In the case of a mixing valve it will balance perfectly to the flow requests from the various branches.

Building Energy Tools Directory



The web-based Building Energy Tools Directory at www.energytoolsdirectory.gov contains information on more than 270 building-related software tools from around the world. Haven't visited it lately? Many new tools have been added over the last several months including: AGI32, EnerCAD, PVSyst, CtrlSpecBuilder, REScheck, SkyVision, The Lightswitch Wizard, Energy CAP, ABACODE, and SMOC-ERS.

For each tool in the directory, a short description is provided along with information about technical expertise required, users, audience, input, output, validation, computer platforms, programming language, strengths, weaknesses, technical contact, availability and cost. A link is also provided for directly translating the web pages into more than 8 languages.

Know of a tool (yours?) that isn't in the directory? Visit http://www.eere.energy.gov/buildings/tools_directory/your_software_here.html or contact Dru Crawley at Drury.Crawley@ee.doe.gov.

GenOpt 2.0β

Generic Optimization Program

GenOpt is an optimization program for the minimization of a cost function, such as annual energy use, that is evaluated by an external simulation program.

GenOpt can be used with any simulation program -- such as EnergyPlus, TRNSYS, SPARK or DOE-2 -- that has text-based input and output. It also offers an interface for adding custom optimization algorithms to its library.

New features of Version 2.0β

Capability to Process Discrete Independent Variables

GenOpt can now process discrete independent variables, such as different window constructions, either for optimization problems with discrete and continuous independent variables or for doing parametric studies.

New Optimization Algorithms

The following optimization algorithms are new in **GenOpt 2.0β**:

- **GPSCoordinateSearch** and **GPSHookeJeeves**: These algorithms are members of the family of Generalized Pattern Search (GPS) algorithms. They can be used to solve optimization problems with continuous independent variables.
- **DiscreteArmijoGradient**: An algorithm that approximates gradients by finite differences and uses the Armijo line search algorithm.
- **PSOCC**, **PSOCCMesh**, and **PSOIW**: These algorithms are members of the family of Particle Swarm Optimization algorithms (which are global heuristic optimization algorithms). They can be used to solve optimization problems with continuous and/or discrete independent variables.
- **GPSPSOCCHJ**: This is a hybrid global optimization algorithm that starts by performing a Particle Swarm Optimization for the continuous and discrete independent variables and then switches to the Hooke-Jeeves Generalized Pattern Search algorithm to refine the continuous independent variables.

Pre- and Post-Processing

Some simulation programs, such as EnergyPlus, cannot pre-process the independent variables or post-process values that are computed during the simulation. For such situations, *input function objects* and *output function objects* can now be used without having to modify **GenOpt's** source code.

GenOpt 2.0β (with documentation) may be downloaded free of charge from
<http://SimulationResearch.lbl.gov> > **GenOpt**

The Forecast Looks Favorable for ...

(Free!) Weather Data on Demand

You can access archived weather data from around the world through this U.S. DOE web interface:



www.eere.energy.gov/buildings/energyplus/cfm/weatherdata/weather_request.cfm

Hourly weather data is continuously collected and stored into a local database, available through this web interface. Most stations have information for dry bulb temperature, wet bulb temperature, wind speed/direction, atmospheric pressure, visibility, cloud conditions, and precipitation type.

Version 3.2 of FTIDOE Released

Finite Technologies Incorporated (FTI) is pleased to announce the release of FTIDOE Version 3.2. Version 3.2 is a continuation of their existing 3.x version of DOE-2 with new features and support for Windows, Solaris and Linux from a single CD.



***New Features in version 3.x include:
multiple platform support, plug-in's,
on-line help, context sensitive text
editor, multiple simulations and on-line
updates.***

Multiple Platform Support

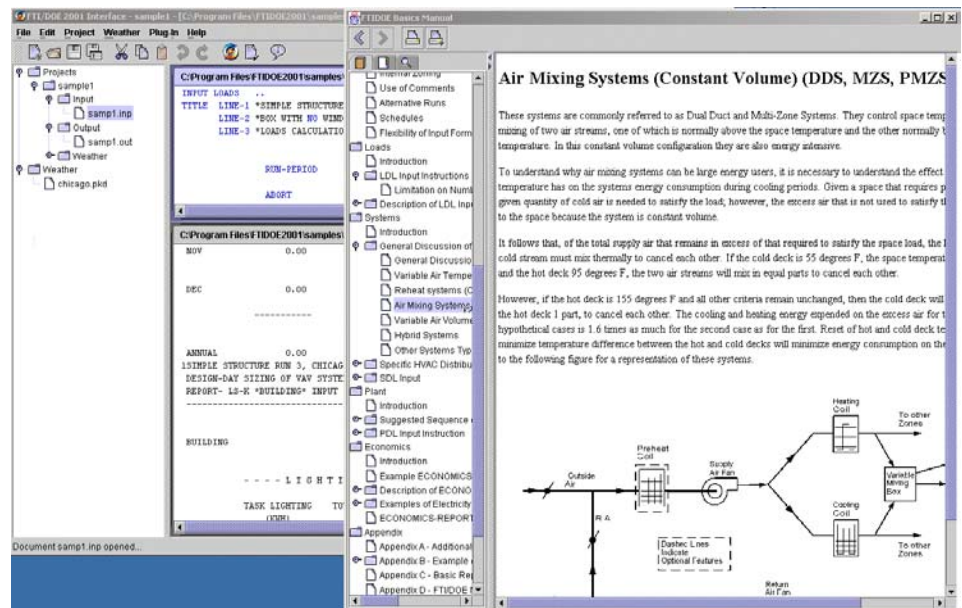
FTIDOE has always been available for most operating systems, but with the release of version 3.2 a single distribution and license provides for Windows 98, Me, NT, 2000 & XP, Linux and Solaris. The software now looks and runs the same on all platforms and the license agreement allows a single installation on the platform of the user's choice. For example, this would enable a user to purchase the program today for Windows and run it on Linux a month from now.

Plug-in's

The Plug-in technology is the most powerful interface feature, enabling users to write custom “plug-ins” that extend the functionality of the interface. This means that users and developers can write almost any functionality they desire and have it become part of the interface. The plug-in feature is simple and the code required is also quite simple. The user writes a Java Bean that provides the functionality desired, copies the Java Bean into the plug-in directory under the installation and, upon restart, the new software appears with the package. FTI is planning a forum to list and provide downloads for user developed plug-in's and an index of commercially developed plug-in's.

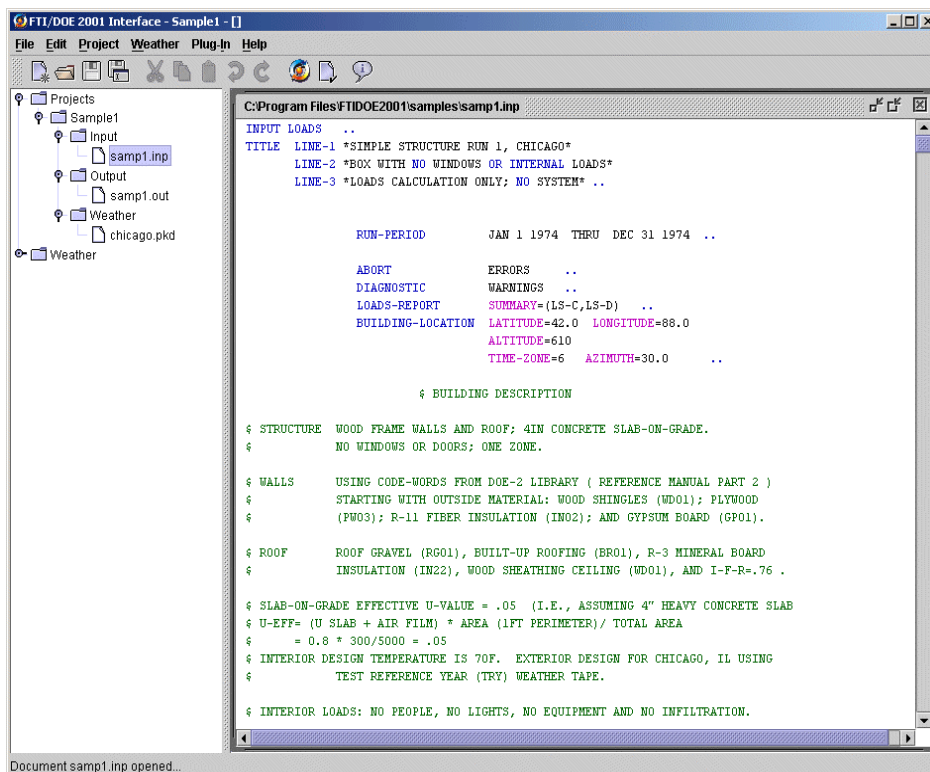
On-line Help

The current on-line help is a rewrite of the DOE-2 Basics Manual with additions for using FTIDOE. This is a fully indexed and searchable help system and a great step forward for DOE-2 documentation. In addition to the on-line help there are PDF versions of all LBNL DOE-2 manuals (6500+ pages).



continued

Version 3.2 of FTIDOE Released (continued)

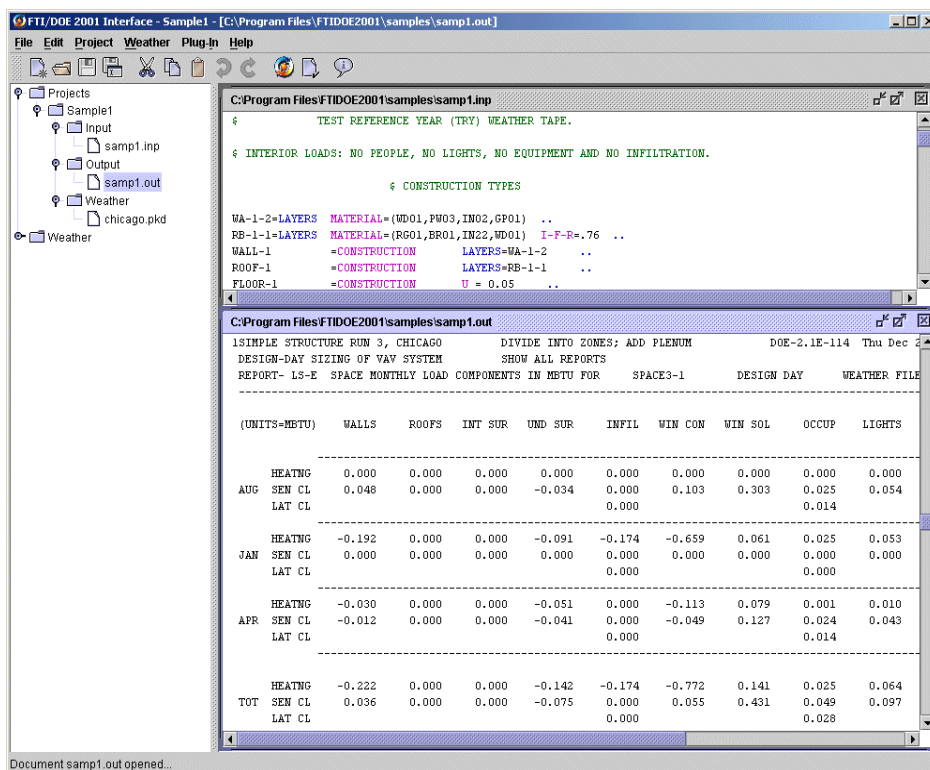


Multiple Simulations & Project Files

With version 3.2 of FTIDOE you can now edit and run as many simulations simultaneously as desired. Now you can run a simulation and continue working or you can run a dozen simulations and continue working. You can also cut, copy and paste among all the open simulation projects.

Command Line Option

FTIDOE's simulation engine can still be executed from the command line; batch/script files show how this is done. There are some users that use this functionality so FTI continues to support command line execution of the simulation engine.



On-line Updates

On-line updates are free for the entire 3.x series of the software. Updates include new features to both the engine and interface and bug fixes. Each time the software starts, it checks to see if there are any new updates; updates are then downloaded and installed. On-line updates mean your engine and interface will always stay current and your software investment is protected.

continued

Version 3.2 of FTIDOE Released (continued)

Weather File Library

FTI maintains an extensive weather file library (www.finite-tech.com/weatherfilelibrary.html). These files are available to anyone -- so enjoy. This library is maintained to support the DOE-2 community, so if you have files that you are willing to share please forward them to FTI and we will be happy to post them. We only accept the original text files, we cannot post the compiled binary versions.

Upgrade Options

We have a several upgrade options for users as follows:

- Existing 3.0 and 3.1 FTIDOE users:
This is a free upgrade, it is a full installation that completely replaces your existing version. It is available via your current on-line update options. This is a very large download and if you prefer we have a minimal media charge to provide you with a new CD.
- FTIDOE Versions Prior to 3.x:
We are offering a substantial upgrade discount to users that have versions of our software that do not support on-line updates. Visit our web site www.finite-tech.com/upgradeoffer.html for more details.
- Competitive upgrades:
We offer a competitive upgrade to users of any energy analysis software towards the purchase of FTIDOE. Visit our website www.finite-tech.com/CompetitiveUpgradeOffer.html for details.

Licensing Options

FTIDOE offers a number of licensing options.

- Standard end user license
where you purchase the software and then do your work.
- Site licensing
is also available allowing you to purchase a single license that allows you to use the software on a unlimited number of desktops at your site. Contact us (<http://www.finite-tech.com/contact.html>) for more information
- Engine licensing
is where we provide a license to use the FTIDOE engine in commercial software or public distributions.

History

Finite Technologies Inc. (FTI) has been providing FTIDOE since 1990 and is the oldest continually supported commercial version of DOE-2.

Verification

FTI provides a version of DOE-2 that is 100 percent compatible with the Energy Science & Technology Software Center's (ESTSC) distribution of DOE-2. Each version of our engine is extensively tested against the ESTSC DOE-2 distribution to verify accuracy of all results.

Contact:

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DOE-2



DOE-2.1E (v. 119) 1,000-Zone version for Windows from ESTSC; other vendors of DOE-2 based programs are listed on our website: <http://SimulationResearch.lbl.gov> > DOE-2

Cost is as follows:

- \$ 300 U.S. Government, non-profit Educational
- \$ 575 U.S., Mexico, Canada
- \$ 1268 Japan only
- \$ 1075 All Other Non-U.S.

DOE-2 Documentation on a CD from ESTSC - Cost US\$100

What is included on the CD?

- DOE-2 Reference Manual (Part 1)
- DOE-2 Reference Manual (Part 2)
- DOE-2 Supplement to the Reference Manual (2.1E)
- DOE-2 BDL Summary (2.1E)
- DOE-2 Engineers Manual (2.1A)

Order Software and ESTSC Documentation

Ed Kidd

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Energy Science and Technology Software Center (ESTSC)

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Oak Ridge, TN 37831

Phone: 865/576-1037

Fax: 865/576-6436

Email: estsc@adonis.osti.gov

Purchase DOE-2 Documentation

DOE-2 Sample Run Book (2.1E) -- The Sample Run book is the only remaining DOE-2 manual not available electronically. It must be purchased separately from NTIS; information is at <http://SimulationResearch.lbl.gov> > DOE-2 > Documentation

Free DOE-2 Documentation (<http://SimulationResearch.lbl.gov> > DOE-2 > Documentation)

- | | |
|---|--|
| <ul style="list-style-type: none">▪ DOE-2 Basics (2.1E)▪ Update Package #1: DOE-2.1E Basics, the Supplement and BDL Summary▪ Update Package #2: (Version 107, DOE-2.1E) BDL Summary and Supplement. | <p>DOE-2 Basics and Update Packages 1, 2, 3 and 4 are not included on the ESTSC CD. They consist of scanned pdf files and may be downloaded from our web site. You may also request the same information on a CD by sending email to klrellington@lbl.gov.</p> <p>The update files need to be printed and the update pages inserted into the existing DOE-2 manuals.</p> |
|---|--|

DOE-2 listings are continued on the next page

--Continued--

Free DOE-2 Documentation (<http://SimulationResearch.lbl.gov> > DOE-2 > Documentation)

- Update Package #3:
Appendix A of the Supplement.
- Update Package #4: (1000-zone DOE-2.1E)
BDL Summary.
- DOE-2 Modeling Tips (pdf)

Note that the Update Packages are **not** cumulative and each one contains different information. You have to download all four packages to update the DOE-2 documentation completely.

DOE-2 Modeling Tips is a compilation of all the "how to" articles from the *Building Energy Simulation User News* (through 2002).

DOE-2 Training

Private or group DOE-2 courses for beginning and advanced users: Contact Marlin Addison at (602) 968-2040, marlin.addison@doe2.com

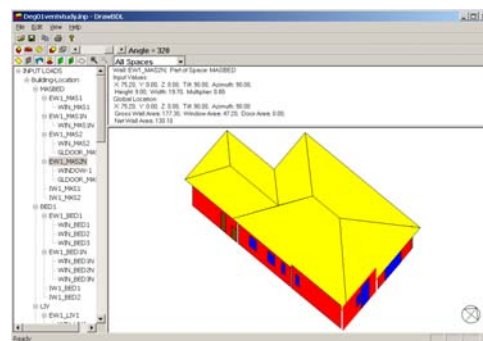
DOE-2 Help Desk

Email, phone or fax the Simulation Research Group with your questions (klrellington@lbl.gov).
Phone: (510) 486-5711, Fax: (510) 486-4089

DrawBDL 3.0

Joe Huang and Associates is pleased to announce Version 3.0 of the DrawBDL program for viewing the building geometry in DOE-2 input and output files. DrawBDL has been completely rewritten using C++ to run in a native 32 bit environment such as Windows 95/2000/NT. In addition to having a new look and feel, Version 3.0 has the following improvements:

- New user interface with a hierarchical tree showing all building surfaces.
- No limit on the number of building surfaces, except for the amount of memory available on the computer.
- For building surfaces, the expanded data window shows not only the input values, but also their locations in the global coordinate system; for spaces, the data window shows the gross and net areas of walls, windows, doors, roofs, and skylights.
- Displays surfaces input as 2-D or 3-D polygons (please see DOE-2.1E Documentation Update #2 http://SimulationResearch.lbl.gov/dirsoft/21e_update2.pdf for the syntax to input surfaces as polygons).
- Changing the sort order of building surfaces used in the display; this allows users to "touch up" the shaded drawings for use in presentations.
- Output the surface data in EnergyPlus *.idf format. This is helpful for DrawBDL users who wish to convert their DOE-2 input files into EnergyPlus input files. Since DrawBDL reads and stores only building surface data, the converted EnergyPlus file is a partial file containing only the inputs for building surfaces.



DrawBDL 3.0

DrawBDL 3.0 costs \$125 plus shipping (same price as the older version); for more information or to order, please contact →

Joe Huang and Associates
31 Sarah Lane
Moraga CA 94556-2563

Phone 925-247-9180
joe@drawbdl.com



The FROM-GROUND Code-Word Error

Question

Under the PLANT-ASSIGNMENT command in SYSTEMS, I attempted to simulate a ground source heat pump by entering code-words FROM-GROUND for HP-LOOP-HEATING and HP-LOOP-COOLING. The program gave me an error because it did not recognize the code-words. Can DOE-2.1E simulate a ground source heat pump? Is the code-word FROM-GROUND valid?

Answer

You said you were using version 110. Here's an item from our Versions.txt file:

-112: dkey sys

Enable FROM-GROUND codeword in PLANT-ASSIGNMENT command
for the HP-LOOP-HEATING keyword.

e.g. HP-LOOP-HEATING=FROM-GROUND is allowed.

[EE 2000.10.05]

The capability you were trying to use had been disabled, most likely because there were problems. Since then several people have used the feature. The current version is 119. I recommend that you upgrade to this version, which has the feature enabled. You may obtain the upgrade from the Energy Science and Technology Software Center (ESTSC), email estsc@adonis.osti.gov, or phone Ed Kidd or Walt Kelly, ESTSC, at 865/576-1037.

Variable Light Transmittance

Question

I use DOE-2.1E in Hong Kong. I want to simulate the energy use of buildings with daylighting control under variable light transmittance on different outdoor illuminance on windows. I found an example of a LOADS input functions in the DOE-2.1E Supplement; it uses the function to vary the shading coefficient of a window, depending on the total solar radiation incident on the window.

Is there another function to vary the light transmittance of a window depending on the different outdoor illuminance on the window? If not, can you give me some guidance on how to model it or point me to the source codes to do a loads function similar with the example?

Answer

The best way to do this in DOE-2.1E is to use switchable glazing (such as electrochromic glazing), which is described on p. 2.118 of the DOE-2.1E Supplement. There are different mechanisms for controlling the transmittance of the glazing, such as the amount of incident solar radiation. There is no explicit control that allows you to vary the transmittance as a function of incident solar illuminance. However, if you use a luminous efficacy of about 100 lumens per watt, you can get the value of incident solar radiation that corresponds to your desired incident illuminance value. For example, if you want a control value of 10,000 lux, i.e., 10,000 lumens/m², the equivalent incident solar radiation value would be 10,000 lumens/m² divided by 100 lumens per watt = 100 W/m². If you are using English units, this should be converted to Btu/hr-ft².



Shading and Visible Transmittance

Question

I'm a little unsure about how to use the visible transmittance schedule with Shading and Daylight Dimming.

Does the visible transmittance schedule define the transmittance for the shading device (and window) for the portion of the window covered by the device (defined by the Shading-Schedule)?

That is, do I define the visible transmittance value as if the entire window were covered by the shade, and then does DOE-2 take care of the rest using the Shading-Schedule?

or...

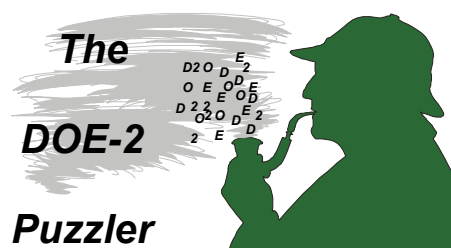
Does the visible transmittance schedule define the effective visual transmittance for the entire window? That is, do I need to define the effective visible transmittance for the entire window considering the shading fraction for each hour (taking the Shading-Schedule into account, which I've already defined)?

Answer

First, it is important to realize that, in DOE-2, when a shading device is 'on' a window it is assumed to cover the entire window. And when the shading device is 'off,' it is fully retracted and so covers none of the window. To model the case where a shading device covers only PART of a window, break the window into two separate windows, one that is always unshaded and one that, when shaded, is fully shaded.

Now for the questions about shading schedule and visible transmittance schedule. SHADING-SCHEDULE (which takes values between 0.0 and 1.0) multiplies the calculated value of the window solar heat gain when the shading device is on. If SHADING-COEFF is specified for a window, this means that SHADING-SCHEDULE multiplies SHADING-COEFF when the shading device is on. Note that various controls can be specified that determine whether the shading device is on or not in a particular hour. A common control is that the shading device is on whenever the transmitted beam solar per unit window area is greater than the value specified by MAX-SOLAR-SCH.

VIS-TRANS-SCH works in a similar way. It multiplies the VIS-TRANS of a window when the shading device is 'on.'



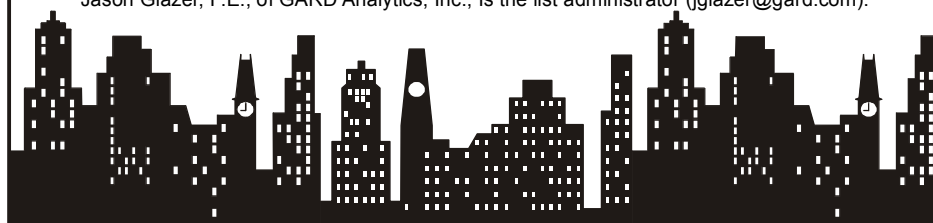
JOIN THE BLDG-SIM MAILING LIST

BLDG-SIM is a mailing list for users of building energy simulation programs like EnergyPlus, DOE-2, Trace-600, HAP, BLAST, ESP, SERIRES, TRNSYS, TASE, ENERGY-10 and others.

Because building simulation professionals are located worldwide, the BLDG-SIM list is an attempt to foster the development of a community of those users. Users of all levels of expertise are welcome and are encouraged to share their questions and insights about these programs. To subscribe, send a blank email message to BLDG-SIM-SUBSCRIBE@GARD.COM

The web page for BLDG-SIM is www.gard.com/bldg-sim.htm

Jason Glazer, P.E., of GARD Analytics, Inc., is the list administrator (jglazer@gard.com).



Building Energy Software

from the Building Technologies Department at Lawrence Berkeley National Laboratory

| Free Downloads | |
|---|--|
| BDA 3.0 (Building Design Advisor) | gaia.lbl.gov/BDA |
| COMIS (multi-zone air flow and contaminant transport model) | www-epb.lbl.gov/comis |
| EnergyPlus 1.1.1 (new-generation whole-building energy analysis program, based on BLAST and DOE-2) | www.energyplus.gov --or-- SimulationResearch.lbl.gov > EnergyPlus |
| GenOpt[®] 2.0β (generic optimization program) | SimulationResearch.lbl.gov > GenOpt |
| Optics 5.1.02 (for analyzing optical properties of glazing systems) | windows.lbl.gov/materials/optics5/ |
| RADIANCE 3.5 (analysis and visualization of lighting in design) Desktop Radiance 2.0β (integrates the Radiance Synthetic Imaging System with AutoCAD Release 14) Radiance Control Panel (automates some Radiance tasks once the model has been created) | radsite.lbl.gov/radiance/ radsite.lbl.gov/deskrad/ www.squ1.com/site.html |
| RESEM (Retrofit Energy Savings Estimation Model) (calculates long-term energy savings directly from actual utility data) | eetd.lbl.gov/btp/resem.htm |
| SUPERLITE (calculates illuminance distribution for room geometries) | eetd.lbl.gov/btp/superlite2.html |
| THERM 5.2 (models two-dimensional heat-transfer effects in building components where thermal bridges are of concern) | windows.lbl.gov/software/therm/therm.html |
| VisualSPARK 2.0 (Simulation Problem Analysis and Research Kernel) (connect component models to simulate innovative building envelope and HVAC systems) | SimulationResearch.lbl.gov > VisualSPARK |
| WINDOW 5.2 (thermal analysis of window products) | windows.lbl.gov/software/window/window.html |
| Free Software / Request by Fax from 510.486.4089 | |
| RESFEN 3.1 (choose energy-efficient, cost-effective windows for a given residential application) | windows.lbl.gov/software/resfen/resfen.html |
| Web Based (free) | |
| Home Energy Saver (quickly computes home energy use) and Home Improvement Tool (simplified Home Energy Saver) | hes.lbl.gov and hit.lbl.gov |



Natural Resources Canada
Ressources naturelles Canada

Canada

Canada's One-Stop Website for Energy Efficiency

<http://oee.nrcan.gc.ca/ici/english/home.cfm?PrintView=N&Text=N>

Energy efficiency retrofits and other measures can reduce operating costs and help reduce greenhouse gas emissions that contribute to climate change. Visit these Web sites to find out about assistance for building and industry available from Natural Resources, Canada's one-stop service for energy efficiency.

Industry

Canadian Industry Program for Energy Conservation (CIPEC)
Industrial Building Incentive Program (IBIP)
Energy Innovators Initiative (EII)

Commercial/ Institutional

Commercial Building Incentive Program (CBIP)

Government

Federal Buildings Initiative (FBI)
Improvements in federal facilities
Federal House in Order Initiative (FHIO)

Tools and Calculators

Simple Payback Calculator
Gigajoule (GJ) and Energy Intensity Calculator
Energy Management Plan
EE Wizard for New Buildings
EE4 for New Buildings



SkyVision

The Canadian government has released **SkyVision**, a new, easy-to-use Windows-based program for modeling skylights. **SkyVision** users are building designers, architects, engineers and skylight manufacturers.

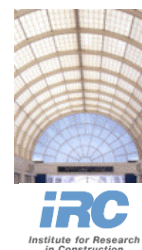
SkyVision offers these features:

- Detailed calculation of skylight optical characteristics and indoor illuminance
- State-of-the-art glazing optics calculation models.
- Ray-tracing-based modelling to compute the skylight optical and daylighting performance.
- Side-by-side comparison of design performance.
- Results in graphical or tabular formats that can be used as inputs for third-party software such as building thermal simulation software.
- Choice of two unit systems: English (IP) or International (SI).
- Attached glass product database to build skylight products.
- Climate file database to simulate scenarios with real, dynamic sky conditions.
- On-line help.
- Automatic lighting and shading control effects.

The program may be freely downloaded for testing and evaluation from <http://irc.nrc-cnrc.gc.ca/ie/light/skyvision/>. For more information, please contact:

Dr. Abdelaziz (Aziz) Laouadi
IRC, Indoor Environment Research Program
National Research Council Canada

1200 Montreal Road, M-24,
Ottawa, Ontario, K1A 0R6
Canada • Tel.: (613) 990 6868





ENERGY-10, VERSION 1.6

ENERGY-10 is a design tool for smaller residential or commercial buildings that are less than 10,000 ft² or buildings that can be treated as 1- or 2-zone increments. It performs whole-building energy analysis for 8760 hours/year, including dynamic thermal and daylighting calculations. **ENERGY-10** was specifically designed to facilitate the evaluation of energy-efficient building features in the very early stages of the design process.

Version 1.6 Upgrades

Synchronize Libraries

Libraries may now be associated with more than one building.

Free Run Mode

Automated process of monitoring how a building operates without any HVAC system.

Clear All Internal Gains

The name is self-explanatory.

New Buttons on Provisional Data Dialog Box

Users may specify whether they want autobuild HVAC sizing to be computed with or without daylighting.

Performance Summary Reports

Three performance summary reports have been added. One is a simple performance summary, which breaks down the standard summary into more readable chunks and adds a column that reflects the percentage change of going from Building 1 to Building 2. The other two are daylighting reports that show the standard daylighting factor calculated for each lighting zone.

New Defaults Library

A new set of libraries contains all the standard libraries such as floorlib, rooflib, etc. with updated values.

Registry Path for ENERGY-10 Data

New registry path allows users to maintain separate copies of the three most recent versions of *ENERGY-10*. In addition, the installation script allows installation for either "all users" or the "current user only."

Additional Tutorials on Installation CD

Three new tutorials are included in the slide show section of the installation CD, including Economics, Daylighting, and Using *ENERGY-10* in the Design Process.

Douglas K. Schroeder
1331 H Street N.W., #1000
Washington, DC 20004



Tel: 202.628.7400 ext 210
Fax: 202.383.5043
www.sbicouncil.org

Sustainable Buildings Industry Council (SBIC)

ENERGY-10 User Group www.sbicouncil.org/forum

SBIC Bookstore www.sbicouncil.org/store/resources.php - pubs



BLASTnews

www.bso.uiuc.edu

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University of Illinois, 30 Mechanical Engineering Building,
1206 West Green Street, Urbana, IL 61801
Tel: (217) 333-3977 - Fax: (217) 244-6534
support@blast.bso.uiuc.edu

The **Building Loads Analysis and System Thermodynamics (BLAST)** program predicts energy consumption, energy system performance and cost for new or existing (pre-retrofit) buildings.

BLAST contains three major sub-programs:

- **Space Load Prediction** computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.
- **Air Distribution System Simulation** uses the computed space loads, weather data, and user inputs.
- **Central Plant Simulation** computes monthly and annual fuel and electrical power consumption.

Heat Balance Loads Calculator (HBLC)

The BLAST graphical interface (HBLC) is a Windows-based interactive program for producing

BLAST input files. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included).

HBLC/BLAST Training Courses

Experience with the HBLC and the BLAST family of programs has shown that new users can benefit from a session of structured training with the software. The Building Systems Laboratory offers such training courses on an as needed basis typically at our offices in Urbana, Illinois.

WINLCCID 98

LCCID (Life Cycle Cost in Design) was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors.

To order BLAST-related products, contact the Building Systems Laboratory at the address above.

| Program Name | Order Number | Price |
|--|--------------|--------|
| PC BLAST Includes: BLAST, HBLC, BTEXT, WIFE, CHILLER, Report Writer, Report Writer File Generator, Comfort Report program, Weather File Reporting Program, Control Profile Macros for Lotus or Symphony, and the Design Week Program. The package is on a single CD-ROM and includes soft copies of the BLAST Manual, 65 technical articles and theses related to BLAST, nearly 400 processed weather files with a browsing engine, and complete source code for BLAST, HBLC, etc. Requires an IBM PC 486/Pentium II or compatible running MS Windows 95/98/NT. | 3B486E3-0898 | \$1500 |
| PC BLAST Package Upgrade from level 295+ | 4B486E3-0898 | \$450 |
| WINLCCID 98: executable version for 386/486/Pentium | 3LCC3-0898 | \$295 |
| WINLCCID 98: update from WINLCCID 97 | 4LCC3-0898 | \$195 |

The last four digits of the catalog number indicate the month and year the item was released or published. This will enable you to see if you have the most recent version. All software will be shipped on 3.5" high density floppy disks unless noted otherwise.

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